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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	)	
	)	
Federal-State Joint Board on Universal Service	)	CC Docket No. 96-45
	)	
Forward-Looking Mechanism for High Cost Support for Non-Rural LECs	)	CC Docket No. 97-160

SUBMISSION OF THE BCPM3 MODEL BY BELLSOUTH CORPORATION, BELLSOUTH TELECOMMUNICATIONS, INC., U S WEST, INC., AND SPRINT LOCAL TELEPHONE COMPANIES

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December 11, 1997

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	)	
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SUBMISSION OF THE BCPM3 MODEL BY
BELLSOUTH CORPORATION, BELLSOUTH TELECOMMUNICATIONS, INC.,
U S WEST, INC., AND
SPRINT LOCAL TELEPHONE COMPANIES

BellSouth, U S WEST, and Sprint Local Telephone Companies (hereinafter "Joint Sponsors") are pleased to submit the Benchmark Cost Proxy Model 3.0 ("BCPM3") for consideration by the Commission and selection as the platform for the federal mechanism for non-rural carriers providing supported services to rural, insular, and high cost areas.

INTRODUCTION

On November 13, 1997, the Common Carrier Bureau ("Bureau") issued Public Notice DA 97-2372 in these dockets requesting parties who seek consideration of their models to submit them within four weeks after the release of the Public Notice.. The Bureau also provided recommendations and guidance to the model developers on a number of subjects concerning the location of customers and the design of outside plant. The Joint Sponsors address each of these subjects and describe how BCPM3 conforms to the Bureau's recommendations.

ATTACHMENT	SUBJECT
1	National summary of BCPM3 results.
2	Why BCPM3 performs the most efficient loop design.
3	Analysis of BCPM3 results utilizing the 12,000 Kft maximum loop length and 18,000 Kft loop length design rules.
4	Critique of Hatfield 5.0 geocoding 3333methodology.
5	BCPM3 Model Methodology

6.	BCPM3 System Documentation
	• Users Manual
	• System Flows
	• Model Logic EXCEL
	• Source Code (provided on CD-ROM)
	    • Grid
	    • Visual Basic

Following are the items of guidance provided in the Notice, along with the BCPM Sponsor's statements of how and why the BCPM3 conforms with each guideline.

GUIDANCE	BCPM RESPONSE
1. The Bureau recommends that models be capable of accepting an using geocode data to the extent that such data are available and reliable. (Pg. 3)	BCPM can accept and use geocoded customer location data. Since the model's network construction is based upon latitude and longitude coordinates, geocoded data can be used in the model with a minimum of preprocessing adjustments. The model itself requires no change to use geocoded data. The BCPM sponsors are concerned that the geocoded data which presently exists does not do an adequate job of locating customers in sparsely populated rural areas, the very customers which the high cost fund is supposed to support. This is so since virtually all of the geocode data, both that utilized in Hatfield 5 and that in the possession of some ILECs, has been derived from address data. While this form of geocoding is highly accurate in densely populated urban (and low cost) areas, it is much less accurate in sparsely populated (high cost) rural areas where addresses are often stated as Rural Routes or Post Office Boxes.
2. The Bureau recommends that models be capable of accepting wire center boundary data in standard Geographic Information System (GIS) format from any source that the Commission finds may estimate	BCPM3 can accept any appropriately geocoded wire center boundary data.

GUIDANCE	BCPM RESPONSE
those boundaries more accurately. (Pg. 4)	
3. To the extent that models' algorithms do not explicitly explore different loop architectures in varying situations and select the least cost alternative for that particular situation, the Bureau recommends that model proponents provide detailed documentation that explains and justifies any assumptions and engineering rules of thumb that their models employ. (Pg. 4)	BCPM3 utilizes a unique algorithm which calculates and compares alternative feeder routes to serve populated grids This algorithm chooses the alternatives using the shortest overall feeder length. This is a significant improvement over algorithms which run all feeder plant at right angles. BCPM3 also utilizes the Carrier Serving Area (CSA) design standard which represents the most efficient state-of-the-art network architecture for distribution plant design. Not only does the CSA architecture result in an efficient network design for basic voice-grade service, but it assures the most efficient provision of access to advanced services, as required by the Telecommunications Act of 1996. Attachment 2 provides a comprehensive description of the CSA architecture, and explains why BCPM3 designs the most efficient network consistent with the requirements of the 1996 Act.
4. The Bureau recommends that each proponent of a model demonstrate how their approaches for deploying DLC devices employ the least-cost, most efficient and reasonable technology as required by the Commission's order (Pg. 5)	Attachment 5 provides a complete explanation of how BCPM3 locates and designs DLC systems and why this represents the most efficient way of delivering the required services to all customers. The use of these DLC devices is consistent with the requirement of the 1996 Act to provide all customers (particularly those in remote rural areas) with access to advanced services comparable to that provided in urban areas. The five state analysis provided in Attachment 3 proves that the CSA concept provides lower cost to meet the specified transmission standards supporting advanced services when all of the relevant costs of using an 18 Kft maximum distance from the DLC are considered.
5. The Bureau recommends that model proponents demonstrate how every aspect of their outside plant design approach is consistent with the least cost criterion, while maintaining the network standards established in the Order. (Pg. 5)	See Attachments 2 and 5.
6. The Bureau recommends that model proponents explain their assumptions about network configurations and capacity, and explain why such assumptions are reasonable and consistent with common configurations and capabilities of non-rural carriers. For example, model proponents should demonstrate how their models permit standard customer premises equipment (CPE) available to consumers today, such as 28.8 Kbps or 56 Kbps modems, to perform at speeds at least as fast as the same CPE can perform on the typical existing network or a non-rural carrier. (Pg. 6)	See Attachment 5 for a complete description of the BCPM3 network design process and logic. See Attachment 2 for a discussion of modem capability of networks.
7. The Bureau recommends that models be capable of accommodating as inputs wireless cost thresholds at the level of the wire center or a smaller	BCPM3 includes the a wireless cost threshold. This threshold is adjustable by wire center.

GUIDANCE	BCPM RESPONSE
geographic unit.	
8. The Bureau recommends that proponents of models provide comparative outputs for each of the following states, using both the 12,000 foot standard, and the 18,000 foot standard: Florida, Georgia, Maryland, Missouri, and Montana. (Pg.7)	Attachment 3 provides details of runs at both the 12 Kft and 18 Kft standards, and an analysis of the differences between these runs.
9. The Bureau recommends that each model proponent submit detailed descriptions of all information or software alleged to be confidential, proprietary , or otherwise unavailable to the public that is used either in the model or in a preprocessing module. (Pg. 7)	All BCPM3 software, both the functioning model and preprocessing algorithms are provided in Attachment 6. None of the software is confidential with the exception of the Local Exchange Routing Guide (LERG) which is the property of Bellcore. Bellcore has offered a procedure to license the use of the LERG for use in BCPM3 upon the payment of a nominal fee. Parties wishing to run BCPM3 who do not wish to enter into this agreement with Bellcore may do so by running the model on the BCPM Web Site located at www.bcpm2.com.
10. The Bureau recommends that model proponents ensure that their modules for determining the location of customers and estimating outside plant investment comply with all or the criteria set out in the Order, in addition to the recommendations in this Public Notice. (Pg. 8) These criteria are listed below:	
a. The technology assumed in the cost study or model must be the least-cost, most efficient and reasonable technology for providing the supported services that is currently being deployed.	YES
b. Any network function or element, such as loop, switching, transport, or signaling, necessary to produce supported services must have an associated cost.	YES
c. Only long-run forward-looking costs may be included.	YES
d. The rate of return should be the authorized federal rate of return on interstate services, currently 11.25%.	BCPM3 comes loaded with two sets of rate of return values. One is the FCC's authorized rate of return of 11.25%, the other is the BCPM sponsors' best estimate of a forward-looking rate of return (approximately 11.4%). The user specifies which set to use before beginning a run.
e. Economic lives and future net salvage percentages used in calculating depreciation expense should be within the FCC-authorized range and use currently authorized depreciation lives.	BCPM3 comes loaded with two sets of depreciation factors. One is the FCC's authorized factors, the other is the BCPM sponsors' best estimate of forward-looking depreciation factors. The user specifies which set to use before beginning a run.
f. The cost study or model must estimate the cost of providing service for all businesses and households within a geographic region.	YES
g. The cost study or model and all underlying data, formulae, computations and software associated with the model should be available to all interested parties for review and comment.	YES

h. The cost study or model should include the capability to examine and modify the critical assumptions and engineering principles.	YES
i. The cost study or model must deaverage support calculations to the wire center serving area level at least, and, if feasible, to even smaller areas such as a CBG, CB or grid cell in order to target efficiently universal service support.	YES

BCPM3 IS THE SUPERIOR PROXY COST MODEL

The FCC and State Commissions are at a critical juncture in selecting the appropriate cost model to use for determining universal service funding. In order for the Federal and State Universal Service programs to achieve their objective of ensuring virtually ubiquitous access to basic telecommunications service, an objective reiterated in the 1996 Telecommunications Act, it is imperative that a cost model: 1) accurately locates customers and 2) efficiently engineers adequate facilities to provide basic service and access to advanced services to customers that reside in high cost areas. The Benchmark Cost Proxy Model, Release 3.0 (BCPM 3.0) effectively attains both of these requirements for an appropriate cost model. Moreover, BCPM 3.0's customer location algorithm is significantly more precise in locating customers than the customer location approaches used in Hatfield 5.0 and the Hybrid Cost Proxy Model (HCPM). Furthermore, BCPM 3.0 is the only model of the three that builds a network that supports access to advanced services as required by the Telecommunications Act.

Therefore, we recommend that the FCC adopt BCPM 3.0 as the appropriate cost proxy model platform for determining universal service support. The following discussion highlights the rationale for our recommendation.

I. CUSTOMER LOCATION

A. BCPM 3.0 versus Hatfield 5.0

The Hatfield developers recognized the deficiencies in their previous releases of Hatfield that relied upon Census data at the Census Block Group (CBG) level to locate customers. Hatfield has attempted to rectify this shortcoming by using geocoded data to locate customers. Geocoding would be optimal if the geocoded information currently available was accurate and comprehensive. Unfortunately, the geocoded information available today is unacceptably incomplete in the areas most critical to the viability of universal service, rural areas.

Hatfield 5.0 relies upon mailing addresses supplied by Metromail Inc. (Metromail) as the data source for providing addresses that can "potentially" be geocoded to a precise latitude and longitude. Unfortunately, Metromail's list of addresses for the U.S. provides only 69% coverage for households in the U.S.

Furthermore, of the 69% for which Metromail provides addresses, a large fraction of those addresses cannot be geocoded. Approximately 80% of the Metromail addresses can be geocoded. The 20% that cannot be geocoded are more likely to reside in rural areas. Rural Route and P.O. Box addresses cannot be geocoded.

Since only 80% of the 69% of customers in the U.S. can be geocoded, Hatfield can geocode less than 56% of the households in the U.S. Moreover, the 44% that Hatfield cannot geocode are likely to reside in rural areas, the very customers who are most likely to be eligible for universal service support.

The Hatfield sponsors stated at the FCC workshops and in their Hatfield Model Preliminary Release 5.0 documentation[1] that those customers who cannot be geocoded are placed along the perimeter of Census Blocks (CBs). Since those customers that Hatfield cannot geocode are likely to reside in rural areas where CBs are much larger than CBs in urban areas, placing customers along the boundaries of CBs is unlikely to substantially enhance the precision from using CB data alone in locating those customers that Hatfield cannot geocode.

Given Hatfield's inability to geocode 44% of the households in the U.S., Hatfield 5.0 places this 44% along the perimeter of the CB. Thus, Hatfield is still guessing about where customers are clustered within a CB, especially in rural areas.

For additional discussion of the accuracy of geocoded data see Attachment 4.

[1] "Hatfield Model Preliminary Release 5.0: Outline Description of Changes in Hatfield Model From Release 4.0 to Preliminary Release 5.0," Hatfield Associates, Inc., November 19, 1997, p. 9.

BCPM 3.0's approach for locating customers is significantly more precise than Hatfield's customer location approach because BCPM 3.0 uses CB data in conjunction with road network data to locate more accurately customers within a CB. This 44% that cannot be geocoded are likely to live along roads. Furthermore, the rights of way that must be granted to build a telecommunications network to serve these customers are likely to exist along roads. BCPM 3.0 reflects these realities.

BCPM 3.0 can easily be altered to accept geocoded data when that information meets the dual qualifications of accuracy and comprehensiveness.

B. BCPM 3.0 versus HCPM

BCPM 3.0 provides greater precision in locating customers than HCPM. This important distinction between the two models stems from two very different approaches for utilizing housing and business line data at the Census Block (CB) level. HCPM uses micrognids that are sized based on the average size of the CBs contained within an ultimate grid and distributes customers uniformly within those microgrids. This is particularly problematic in those areas where precision is most needed, high cost areas where the CBs tend to be relatively large. In contrast, BCPM assigns customers within a CB to microgrids comprising that CB, based on the proportion of roads contained within each microgrid. BCPM 3.0's use of road network data facilitates a more accurate identification of clusters of customers in high cost areas.

In contrast to BCPM 3.0, HCPM builds to occupied households rather than housing units which include both occupied and unoccupied households. Since providing facilities to unoccupied households is an important aspect of achieving the obligation to serve in a timely fashion, HCPM underestimates the cost of building a network that can provide universal service. The enhanced BCPM takes into account all housing units when constructing facilities.

In addition, BCPM 3.0's wire center boundaries are also substantially more accurate than those used in HCPM. HCPM uses data from On Target Mapping to establish wire center boundaries. Although previous versions of BCPM used On Target Mapping data for wire center boundaries, BCPM 3.0 now uses data obtained from

Business Location Research (BLR). BLR provides substantially more accurate wire center boundaries than does On Target Mapping.

II. OUTSIDE PLANT

A. BCPM 3.0 Designs an Efficient Network

Locating customers is only one significant component of designing an appropriate cost proxy model for determining universal service support. The other key ingredient is designing an efficient network that can provide basic service, utilizing the precision in locating those customers described above. BCPM 3.0 integrates customer location information with forward-looking, least cost engineering practices. This creative approach recognizes that telephone plant engineers do not typically build plant on a customer by customer basis. Rather, they plan and build plant based on Carrier Serving Areas (CSA) and Distribution Areas. Thus, engineers recognize actual clustering of customers when implementing standard engineering practices that try to maximize the efficient use of plant, minimize the distribution portion of plant, and ensure adequate service quality. The CSA is also the standard that equipment manufacturers use for the design of their products. Following these industry standards assures that when loops are connected to the network in other parts of the country, or even other parts of the world, the resulting circuit will provide satisfactory end-to-end transmission.

Using the CSA as the platform for engineering, BCPM 3.0 formulates grids that vary in size to appropriately conform to the requirements of a CSA, given the location of customers throughout the wire center. Furthermore, the maximum grid size is constrained so that the limitations of copper distribution are not exceeded.

While staying within commonly accepted engineering standards, BCPM works to optimize its network design. For example, in BCPM 3.0, main feeder beyond 10,000 feet from the wire center may be split and directed toward population clusters or it may run directly north, south, east, and west from the wire center. The alternative selected minimizes the total feeder route length. BCPM 3.0 also optimizes with respect to the number of Feeder Distribution Interfaces (FDIs) placed. The FDI may be co-located with the DLC to serve the distribution areas within a CSA; FDIs may be shared between the two distribution quadrants located to the left of the DLC and the two distribution quadrants located to the right of the DLC; or an FDI may be placed in each non-empty distribution quadrant. The placement of the FDI(s) is determined based on the cost minimizing alternative.

B. Network Design: BCPM versus Hatfield

BCPM 3.0's integration of customer location and outside plant design ensures that BCPM 3.0 takes the cable to the customers as opposed to Hatfield 5.0's moving customers to the cables. Hatfield 5.0 uses a non-standard engineering approach to outside plant design, that does not conform to the industry standards for a CSA. For example, the 18,000-foot copper loops designed in Hatfield do not account for the extended range plug-ins required to provide access to advanced services for customers located more than 900 ohms from the Remote Terminal location. (See Attachment 2)

C. Network Design: BCPM versus HCPM

HCPM attempts to minimize the cost of building a network by specifying, a priori, a narrow range of alternative approaches for designing outside plant. Moreover, the criteria used in HCPM for deploying the three specified alternative technologies, (i.e. copper cable, fiber, and T1 copper), do not adequately account for differences in the quality of transmission standard, the speed of transmission, the degradation of the signal, and the ability to support advanced services across these three technologies.

CONCLUSION

The Benchmark Cost Proxy Model 3.0 conforms to the Commission's requirements in the Universal Service Order and to the Bureau's recommendations and guidance in the Public Notice, and should be adopted as the platform for the ongoing analysis of high cost support for non-rural LECs.

Respectfully submitted,

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December 11, 1997

CERTIFICATE OF SERVICE

I, Kelseau Powe, Jr., do hereby certify that on this 11th day of December, 1997, I have caused an original and three copies of the foregoing submission to be filed with the Office of the Secretary and copies (as indicated below) to be served, via hand-delivery, upon the following:

Chuck Keller
Federal Communications Commission
Room 8918
2100 M Street, N.W.
Washington, DC 20554
(4 copies)

International Transcription Services, Inc.
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Washington, DC 20036
(1 copy, including CD-Rom)

Kelseau Powe, Jr.

CC9645PROX-COS

NATIONAL RESULTS PREFACE

The BCPM sponsors, BellSouth, Sprint and U S WEST, are please to present to the Commission the Benchmark Cost Proxy Model 3 (BCPM3) for their adoption as the standard platform for the further development of plans for meeting the universal service objectives of the Telecommunications Act of 1996. We believe that this model truly reflects the state-of-the-art in proxy models for use in analyzing universal service alternatives. The model is complete, fully documented, and open. We are ready and willing to work with the FCC and Joint Board Staff in further adapting the model for use in the design of explicit funding for non-rural telephone companies to begin January 1, 1999.

In filing the model, however, we wish to make two observations regarding the results submitted with the model which must at this time, for reasons discussed below, be considered to be illustrative only.

First, the FCC wisely separated the review of proxy models into two phases - Platform and Inputs. Following the upcoming decision on platform, all parties will turn their attention to the development of the appropriate inputs, which experience has shown will have a significant impact on the final funding levels. Due to this bifurcated approach, the BCPM sponsors have devoted virtually all of our energy and resources to the development and refinement of the program platform. For the most part, the inputs used in these model runs are unchanged from BCPM1.1. The sponsors therefore reserve their individual judgement on what the necessary funding levels will be until we have completed our further analysis of the appropriate input factors in the next phase of this proceeding.

Second, one of the most significant enhancements that we have made in BCPM3 is the ability to determine specific customer locations far more accurately than prior models have allowed. Rather than locating all customers in a road-reduced rectangle at the centroid of the Census Block Group (CBG) (as was done in BCPM1.1), we are now able to place customers more accurately using Census Block and road network data, and assure that appropriate outside plant facilities are constructed to connect them to the network. This added granularity and precision has caused some modest shifts in output results, and raised at least one new area of policy concern which we believe merits further consideration and review.

In general, the more precise location of customers has resulted in reduced output results in areas where customers are closely clustered, and higher results in areas where customers are more dispersed. Of note, however, is that in the most remote and sparsely populated states, the results have increased significantly. We believe that this is due to the very high cost of bringing state-of-the-art technology to all customer locations, even those in the most rural and remote areas.

As described more fully in our filing, BCPM3 constructs a network, capable of access to advanced telecommunications services to all customer locations, even the most remote and rural locations, as directed in Section 254(b)(3) of the 1996 Act. The new precision which BCPM3 provides in locating customers gives industry and regulators a tool to understand the cost of implementing this Congressional directive. BCPM3 designs telephone service to all known household locations. Due to their extreme remote location, some housing units may not currently have any telephone service at all, yet the model will "construct" service to their location, sometimes at the cost of hundreds of thousands of dollars per subscriber. Also we are "building" service capable of 28.8 Bps modem access to all rural locations, whereas the present serving arrangements for remotely located customers may not currently support this quality of service. We believe that this phenomenon is responsible for the higher results evidenced in some of the more remote western states such as Montana, and the Dakotas. This information can be a valuable tool in determining what federal policy should be in providing service to these customers, and how this service should be paid for.

It should be noted, however, that these results are not the result of BCPM3 per se, but rather the results of the network design assumptions which we asked BCPM3 to use in designing facilities to serve all customers. The open and flexible nature of the BCPM3 platform allows for the substitution of alternative technologies or assumptions for serving the very remote rural customer. The BCPM3 sponsors look forward to working with the Commission and Joint Board Staff as this proceeding continues.

BCPM3 National Results
(Illustrative)

		Capped										
		Investment Per Line					Expense Per Line			Support		
ID	State	Loop	Switch	IOF	Other	Total	Capital Cost	Operating Expense	Total Cost	Res Support Over $30	Bus Support Over $30	Res Support over $31 and Bus over $51
AK	Alaska (Anchorage)	$ 734	$ 251	$ 4	$ 74	$ 1,063	$ 16.48	$ 11.34	$ 27.82	$ 1,903,388	$ 160,657	$ 1,614,380
AL	Alabama	$ 1,701	$ 310	$ 14	$ 134	$ 2,159	$ 33.83	$ 11.34	$ 45.17	$ 379,408,909	$ 5,693,695	$ 366,965,656
AR	Arkansas	$ 2,207	$ 378	$ 18	$ 170	$ 2,774	$ 43.35	$ 11.34	$ 54.69	$ 341,048,621	$ 5,787,614	$ 334,540,379
AZ	Arizona	$ 1,096	$ 279	$ 151	$ 105	$ 1,631	$ 25.60	$ 11.34	$ 36.94	$ 184,908,301	$ 2,648,992	$ 176,271,415
CA	California	$ 711	$ 205	$ 7	$ 66	$ 989	$ 15.36	$ 11.34	$ 26.70	$ 371,251,136	$ 60,593,529	$ 375,226,336
CO	Colorado	$ 1,113	$ 289	$ 25	$ 100	$ 1,528	$ 23.82	$ 11.34	$ 35.16	$ 151,962,062	$ 2,678,188	$ 145,303,973
CT	Connecticut	$ 876	$ 229	$ 2	$ 78	$ 1,186	$ 18.54	$ 11.34	$ 29.88	$ 58,462,819	$ 1,122,779	$ 52,260,623
DC	District of Columbia	$ 338	$ 235	$ 1	$ 51	$ 625	$ 9.69	$ 11.34	$ 21.03	$ 85,337	$ 289	$ 47,828
DE	Delaware	$ 893	$ 245	$ 3	$ 81	$ 1,223	$ 19.13	$ 11.34	$ 30.47	$ 18,967,030	$ 209,589	$ 17,849,602
FL	Florida	$ 899	$ 236	$ 8	$ 81	$ 1,224	$ 19.07	$ 11.34	$ 30.41	$ 283,154,970	$ 8,890,629	$ 259,199,639
GA	Georgia	$ 1,294	$ 266	$ 8	$ 106	$ 1,673	$ 26.23	$ 11.34	$ 37.57	$ 405,184,728	$ 3,979,427	$ 386,727,193
HI	Hawaii	$ 689	$ 283	$ 26	$ 77	$ 1,074	$ 16.74	$ 11.34	$ 28.08	$ 16,936,779	$ 2,333,660	$ 16,475,983
IA	Iowa	$ 1,930	$ 505	$ 25	$ 173	$ 2,633	$ 41.11	$ 11.34	$ 52.45	$ 370,178,084	$ 7,411,671	$ 365,569,333
ID	Idaho	$ 1,701	$ 357	$ 15	$ 140	$ 2,212	$ 34.50	$ 11.34	$ 45.84	$ 107,448,673	$ 3,915,491	$ 106,730,849
IL	Illinois	$ 894	$ 287	$ 12	$ 88	$ 1,281	$ 19.96	$ 11.34	$ 31.30	$ 403,931,237	$ 8,104,784	$ 390,357,147
IN	Indiana	$ 1,308	$ 293	$ 11	$ 110	$ 1,722	$ 26.95	$ 11.34	$ 38.29	$ 343,127,650	$ 6,892,925	$ 330,775,744
KY	Kentucky	$ 1,716	$ 309	$ 13	$ 134	$ 2,172	$ 33.99	$ 11.34	$ 45.33	$ 365,931,244	$ 7,391,033	$ 357,786,164
LA	Louisiana	$ 1,340	$ 308	$ 12	$ 114	$ 1,774	$ 27.71	$ 11.34	$ 39.05	$ 256,936,702	$ 3,033,549	$ 248,177,008
MA	Massachusetts	$ 741	$ 160	$ 2	$ 62	$ 965	$ 15.05	$ 11.34	$ 26.39	$ 61,152,080	$ 8,515,946	$ 55,926,286
MD	Maryland	$ 763	$ 250	$ 6	$ 75	$ 1,094	$ 17.09	$ 11.34	$ 28.43	$ 82,706,031	$ 1,028,312	$ 76,276,573
ME	Maine	$ 1,774	$ 211	$ 13	$ 124	$ 2,122	$ 33.26	$ 11.34	$ 44.60	$ 112,613,546	$ 10,990,034	$ 114,527,532
MI	Michigan	$ 1,114	$ 270	$ 7	$ 97	$ 1,487	$ 23.27	$ 11.34	$ 34.61	$ 397,501,959	$ 12,493,343	$ 384,492,000
MN	Minnesota	$ 1,417	$ 379	$ 14	$ 128	$ 1,939	$ 30.26	$ 11.34	$ 41.60	$ 377,616,152	$ 2,147,546	$ 368,188,756
MO	Missouri	$ 1,534	$ 377	$ 9	$ 134	$ 2,054	$ 32.02	$ 11.34	$ 43.36	$ 483,672,599	$ 6,781,795	$ 473,027,079
MS	Mississippi	$ 2,195	$ 342	$ 12	$ 164	$ 2,714	$ 42.50	$ 11.34	$ 53.84	$ 340,620,139	$ 5,182,101	$ 333,451,817
MT	Montana	$ 2,183	$ 463	$ 58	$ 183	$ 2,886	$ 44.94	$ 11.34	$ 56.28	$ 116,528,422	$ 3,209,466	$ 115,629,012
NC	North Carolina	$ 1,367	$ 270	$ 9	$ 110	$ 1,756	$ 27.60	$ 11.34	$ 38.94	$ 431,335,386	$ 9,456,290	$ 411,546,209
ND	North Dakota	$ 2,179	$ 512	$ 28	$ 188	$ 2,907	$ 45.21	$ 11.34	$ 56.55	$ 101,263,147	$ 1,443,354	$ 100,468,300
NE	Nebraska	$ 1,651	$ 440	$ 29	$ 150	$ 2,270	$ 35.37	$ 11.34	$ 46.71	$ 183,353,647	$ 4,263,415	$ 181,331,894
NH	New Hampshire	$ 1,300	$ 181	$ 6	$ 94	$ 1,580	$ 24.82	$ 11.34	$ 36.16	$ 56,511,144	$ 8,037,555	$ 56,642,789
NJ	New Jersey	$ 534	$ 210	$ 2	$ 57	$ 803	$ 12.56	$ 11.34	$ 23.90	$ 42,806,359	$ 790,580	$ 37,007,584
NM	New Mexico	$ 1,574	$ 343	$ 29	$ 132	$ 2,078	$ 32.43	$ 11.34	$ 43.77	$ 127,625,732	$ 2,653,294	$ 124,383,765
NV	Nevada	$ 821	$ 939	$ 315	$ 190	$ 2,265	$ 35.53	$ 11.34	$ 46.87	$ 149,999,563	$ 23,546,078	$ 163,412,914
NY	New York	$ 702	$ 227	$ 5	$ 69	$ 1,003	$ 15.64	$ 11.34	$ 26.98	$ 346,480,712	$ 34,143,449	$ 339,740,185
OH	Ohio	$ 1,062	$ 281	$ 8	$ 96	$ 1,446	$ 22.60	$ 11.34	$ 33.94	$ 419,339,447	$ 9,832,879	$ 400,091,096
OK	Oklahoma	$ 1,726	$ 385	$ 15	$ 146	$ 2,271	$ 35.45	$ 11.34	$ 46.79	$ 344,892,748	$ 4,433,321	$ 336,358,698
OR	Oregon	$ 1,278	$ 300	$ 28	$ 111	$ 1,717	$ 26.78	$ 11.34	$ 38.12	$ 183,570,280	$ 5,620,215	$ 178,553,242
PA	Pennsylvania	$ 968	$ 262	$ 5	$ 88	$ 1,324	$ 20.66	$ 11.34	$ 32.00	$ 406,274,344	$ 7,075,904	$ 386,183,481
PR	Puerto Rico	$ 832	$ 227	$ 3	$ 76	$ 1,138	$ 17.76	$ 11.34	$ 29.10	$ 42,940,171	$ 35,964	$ 36,892,283
RI	Rhode Island	$ 847	$ 221	$ 2	$ 76	$ 1,145	$ 17.83	$ 11.34	$ 29.17	$ 13,025,666	$ 2,101,603	$ 11,693,080
SC	South Carolina	$ 1,518	$ 297	$ 19	$ 123	$ 1,957	$ 30.73	$ 11.34	$ 42.07	$ 260,172,608	$ 4,496,257	$ 249,317,936
SD	South Dakota	$ 2,325	$ 633	$ 34	$ 213	$ 3,205	$ 49.88	$ 11.34	$ 61.22	$ 127,332,822	$ 1,786,896	$ 126,174,385
TN	Tennessee	$ 1,408	$ 286	$ 17	$ 115	$ 1,826	$ 28.64	$ 11.34	$ 39.98	$ 347,181,117	$ 3,809,410	$ 332,466,484
TX	Texas	$ 1,161	$ 293	$ 23	$ 103	$ 1,581	$ 24.69	$ 11.34	$ 36.03	$ 899,078,572	$ 16,095,494	$ 865,421,464
UT	Utah	$ 977	$ 306	$ 14	$ 95	$ 1,392	$ 21.70	$ 11.34	$ 33.04	$ 49,956,587	$ 659,964	$ 47,388,139
VA	Virginia	$ 1,170	$ 268	$ 10	$ 100	$ 1,547	$ 24.21	$ 11.34	$ 35.55	$ 350,502,416	$ 5,093,530	$ 337,556,730
VT	Vermont	$ 1,867	$ 315	$ 11	$ 143	$ 2,336	$ 36.61	$ 11.34	$ 47.95	$ 61,863,881	$ 8,767,923	$ 64,655,768
WA	Washington	$ 1,086	$ 276	$ 10	$ 96	$ 1,468	$ 22.89	$ 11.34	$ 34.23	$ 213,382,507	$ 6,546,596	$ 204,801,684
WI	Wisconsin	$ 1,390	$ 319	$ 8	$ 118	$ 1,835	$ 28.67	$ 11.34	$ 40.01	$ 375,505,037	$ 8,303,062	$ 368,428,420
WV	West Virginia	$ 2,138	$ 332	$ 10	$ 160	$ 2,640	$ 41.20	$ 11.34	$ 52.54	$ 240,622,981	$ 2,491,484	$ 234,961,170
WY	Wyoming	$ 1,902	$ 388	$ 42	$ 157	$ 2,489	$ 38.78	$ 11.34	$ 50.12	$ 49,694,246	$ 930,718	$ 48,757,707
	Total									$ 11,857,949,719	$ 353,612,278	$ 11,497,633,713

BCPM3 National Results
(Illustrative)

		Uncapped										
		Investment Per Line					Expense Per Line			Support		
ID	State	Loop	Switch	IOF	Other	Total	Capital Cost	Operating Expense	Total Cost	Res Support Over $30	Bus Support Over $30	Res Support over $31 and Bus over $51
AK	Alaska (Anchorage)	$ 749	$ 251	$ 4	$ 75	$ 1,079	$ 16.71	$ 11.34	$ 28.05	$ 2,140,696	$ 172,582	$ 1,863,613
AL	Alabama	$ 1,792	$ 310	$ 14	$ 139	$ 2,255	$ 35.28	$ 11.34	$ 46.62	$ 414,504,541	$ 5,863,365	$ 402,230,952
AR	Arkansas	$ 2,551	$ 378	$ 18	$ 188	$ 3,136	$ 48.84	$ 11.34	$ 60.18	$ 416,461,376	$ 6,263,844	$ 410,429,357
AZ	Arizona	$ 1,423	$ 279	$ 151	$ 122	$ 1,975	$ 30.79	$ 11.34	$ 42.13	$ 276,129,210	$ 3,440,377	$ 268,283,711
CA	California	$ 765	$ 205	$ 7	$ 69	$ 1,046	$ 16.21	$ 11.34	$ 27.55	$ 503,182,195	$ 75,271,958	$ 521,835,834
CO	Colorado	$ 1,546	$ 289	$ 25	$ 123	$ 1,984	$ 30.67	$ 11.34	$ 42.01	$ 260,824,649	$ 3,660,477	$ 255,148,853
CT	Connecticut	$ 877	$ 229	$ 2	$ 78	$ 1,187	$ 18.56	$ 11.34	$ 29.90	$ 58,838,215	$ 1,124,989	$ 52,638,229
DC	District of Columbia	$ 338	$ 235	$ 1	$ 51	$ 625	$ 9.69	$ 11.34	$ 21.03	$ 85,337	$ 289	$ 47,828
DE	Delaware	$ 896	$ 245	$ 3	$ 82	$ 1,226	$ 19.17	$ 11.34	$ 30.51	$ 19,131,048	$ 210,271	$ 18,014,301
FL	Florida	$ 922	$ 236	$ 8	$ 82	$ 1,248	$ 19.44	$ 11.34	$ 30.78	$ 311,892,775	$ 9,581,438	$ 288,628,254
GA	Georgia	$ 1,348	$ 266	$ 8	$ 109	$ 1,730	$ 27.08	$ 11.34	$ 38.42	$ 443,053,903	$ 4,082,661	$ 424,699,602
HI	Hawaii	$ 720	$ 283	$ 26	$ 79	$ 1,107	$ 17.22	$ 11.34	$ 28.56	$ 19,391,551	$ 2,520,469	$ 19,117,562
IA	Iowa	$ 2,265	$ 505	$ 25	$ 191	$ 2,986	$ 46.52	$ 11.34	$ 57.86	$ 462,255,736	$ 7,856,998	$ 458,092,297
ID	Idaho	$ 2,846	$ 357	$ 15	$ 201	$ 3,419	$ 52.64	$ 11.34	$ 63.98	$ 188,993,510	$ 5,665,623	$ 190,025,813
IL	Illinois	$ 938	$ 287	$ 12	$ 90	$ 1,326	$ 20.66	$ 11.34	$ 32.00	$ 460,769,156	$ 8,292,070	$ 447,382,339
IN	Indiana	$ 1,330	$ 293	$ 11	$ 112	$ 1,745	$ 27.31	$ 11.34	$ 38.65	$ 355,930,257	$ 6,946,407	$ 343,631,827
KY	Kentucky	$ 1,789	$ 309	$ 13	$ 138	$ 2,249	$ 35.15	$ 11.34	$ 46.49	$ 391,239,511	$ 7,526,506	$ 383,229,896
LA	Louisiana	$ 1,435	$ 308	$ 12	$ 119	$ 1,874	$ 29.23	$ 11.34	$ 40.57	$ 290,419,930	$ 3,171,403	$ 281,798,093
MA	Massachusetts	$ 744	$ 160	$ 2	$ 62	$ 968	$ 15.10	$ 11.34	$ 26.44	$ 62,739,348	$ 8,572,129	$ 57,569,737
MD	Maryland	$ 767	$ 250	$ 6	$ 76	$ 1,099	$ 17.15	$ 11.34	$ 28.49	$ 84,462,454	$ 1,043,184	$ 78,047,875
ME	Maine	$ 2,132	$ 211	$ 13	$ 143	$ 2,500	$ 38.93	$ 11.34	$ 50.27	$ 127,830,637	$ 14,110,389	$ 132,864,982
MI	Michigan	$ 1,180	$ 270	$ 7	$ 100	$ 1,556	$ 24.32	$ 11.34	$ 35.66	$ 439,514,977	$ 13,118,653	$ 427,130,328
MN	Minnesota	$ 1,714	$ 379	$ 14	$ 144	$ 2,252	$ 35.01	$ 11.34	$ 46.35	$ 495,740,324	$ 2,410,949	$ 486,576,334
MO	Missouri	$ 1,709	$ 377	$ 9	$ 143	$ 2,238	$ 34.83	$ 11.34	$ 46.17	$ 576,815,977	$ 7,081,027	$ 566,469,703
MS	Mississippi	$ 2,383	$ 342	$ 12	$ 174	$ 2,911	$ 45.49	$ 11.34	$ 56.83	$ 383,812,151	$ 5,380,590	$ 376,842,308
MT	Montana	$ 5,684	$ 463	$ 58	$ 368	$ 6,573	$ 100.48	$ 11.34	$ 111.82	$ 303,899,322	$ 5,763,261	$ 305,553,703
NC	North Carolina	$ 1,393	$ 270	$ 9	$ 112	$ 1,783	$ 28.01	$ 11.34	$ 39.35	$ 448,614,603	$ 9,559,214	$ 428,928,351
ND	North Dakota	$ 5,426	$ 512	$ 28	$ 360	$ 6,326	$ 97.37	$ 11.34	$ 108.71	$ 280,852,778	$ 2,203,845	$ 280,818,414
NE	Nebraska	$ 2,745	$ 440	$ 29	$ 208	$ 3,422	$ 52.93	$ 11.34	$ 64.27	$ 349,958,010	$ 5,611,315	$ 349,284,158
NH	New Hampshire	$ 1,362	$ 181	$ 6	$ 97	$ 1,646	$ 25.81	$ 11.34	$ 37.15	$ 60,551,184	$ 9,108,727	$ 61,753,999
NJ	New Jersey	$ 535	$ 210	$ 2	$ 58	$ 804	$ 12.58	$ 11.34	$ 23.92	$ 43,785,152	$ 798,401	$ 37,994,197
NM	New Mexico	$ 2,766	$ 343	$ 29	$ 196	$ 3,334	$ 51.35	$ 11.34	$ 62.69	$ 249,130,782	$ 3,822,549	$ 247,058,071
NV	Nevada	$ 1,102	$ 939	$ 315	$ 205	$ 2,561	$ 39.93	$ 11.34	$ 51.27	$ 181,336,698	$ 26,049,210	$ 197,253,181
NY	New York	$ 719	$ 227	$ 5	$ 70	$ 1,022	$ 15.92	$ 11.34	$ 27.26	$ 368,070,096	$ 36,758,328	$ 363,944,471
OH	Ohio	$ 1,070	$ 281	$ 8	$ 96	$ 1,455	$ 22.74	$ 11.34	$ 34.08	$ 428,692,829	$ 9,879,024	$ 409,490,612
OK	Oklahoma	$ 2,172	$ 385	$ 15	$ 169	$ 2,741	$ 42.61	$ 11.34	$ 53.95	$ 480,065,085	$ 5,075,131	$ 472,172,846
OR	Oregon	$ 1,744	$ 300	$ 28	$ 135	$ 2,207	$ 34.14	$ 11.34	$ 45.48	$ 294,699,090	$ 6,712,475	$ 290,774,312
PA	Pennsylvania	$ 993	$ 262	$ 5	$ 89	$ 1,349	$ 21.05	$ 11.34	$ 32.39	$ 428,778,057	$ 7,478,875	$ 409,090,161
PR	Puerto Rico	$ 832	$ 227	$ 3	$ 76	$ 1,138	$ 17.77	$ 11.34	$ 29.11	$ 43,103,860	$ 35,964	$ 37,055,972
RI	Rhode Island	$ 847	$ 221	$ 2	$ 76	$ 1,146	$ 17.84	$ 11.34	$ 29.18	$ 13,063,516	$ 2,101,880	$ 11,731,207
SC	South Carolina	$ 1,566	$ 297	$ 19	$ 125	$ 2,007	$ 31.49	$ 11.34	$ 42.83	$ 275,340,368	$ 4,558,312	$ 264,547,753
SD	South Dakota	$ 5,170	$ 633	$ 34	$ 363	$ 6,201	$ 95.42	$ 11.34	$ 106.76	$ 296,872,911	$ 2,522,831	$ 296,450,413
TN	Tennessee	$ 1,453	$ 286	$ 17	$ 117	$ 1,873	$ 29.35	$ 11.34	$ 40.69	$ 369,006,477	$ 3,875,172	$ 354,357,599
TX	Texas	$ 1,431	$ 293	$ 23	$ 118	$ 1,865	$ 28.99	$ 11.34	$ 40.33	$ 1,283,947,838	$ 20,760,395	$ 1,254,955,631
UT	Utah	$ 1,414	$ 306	$ 14	$ 118	$ 1,852	$ 28.56	$ 11.34	$ 39.90	$ 83,733,966	$ 984,333	$ 81,489,897
VA	Virginia	$ 1,205	$ 268	$ 10	$ 101	$ 1,584	$ 24.76	$ 11.34	$ 36.10	$ 373,717,743	$ 5,223,490	$ 360,902,017
VT	Vermont	$ 1,981	$ 315	$ 11	$ 149	$ 2,456	$ 38.40	$ 11.34	$ 49.74	$ 66,648,131	$ 9,471,134	$ 70,143,221
WA	Washington	$ 1,294	$ 276	$ 10	$ 107	$ 1,687	$ 26.21	$ 11.34	$ 37.55	$ 309,362,246	$ 7,638,128	$ 301,872,967
WI	Wisconsin	$ 1,498	$ 319	$ 8	$ 124	$ 1,950	$ 30.41	$ 11.34	$ 41.75	$ 422,387,977	$ 8,668,550	$ 415,676,847
WV	West Virginia	$ 2,337	$ 332	$ 10	$ 170	$ 2,850	$ 44.36	$ 11.34	$ 55.70	$ 272,529,160	$ 2,684,133	$ 267,060,006
WY	Wyoming	$ 4,525	$ 388	$ 42	$ 296	$ 5,252	$ 80.30	$ 11.34	$ 91.64	$ 120,200,574	$ 1,724,031	$ 120,057,348
	Total									$ 14,894,507,915	$ 402,437,360	$ 14,583,016,977

BCPM3 National Results

		Line Data							
ID	**State**	**Average Loop Length**	**Lines Above Loop Cap**	**Number Of Households**	**Residential Lines**	**Single Business Lines**	**Multiple Business Lines**	**Non Switched Lines**	**Total Grid Lines**
AK	Alaska (Anchorage)	12,115	95	82,550	90,381	14,949	37,817	6,860	150,007
AL	Alabama	23,648	23,680	1,587,095	1,725,963	75,104	467,950	70,597	2,339,614
AR	Arkansas	20,697	41,162	929,015	933,742	46,501	233,122	36,351	1,249,716
AZ	Arizona	17,085	22,206	1,550,907	1,743,602	33,908	587,120	80,734	2,445,363
CA	California	12,268	40,605	11,005,577	12,891,851	3,840,976	3,327,699	931,928	20,992,454
CO	Colorado	16,180	22,660	1,439,942	1,652,142	44,034	621,134	86,472	2,403,782
CT	Connecticut	14,421	239	1,220,705	1,347,155	55,322	560,737	80,088	2,043,302
DC	District of Columbia	5,595	-	227,971	288,627	3,473	340,399	44,703	677,203
DE	Delaware	16,191	164	266,501	321,769	12,492	157,692	22,124	514,077
FL	Florida	17,483	12,084	5,616,786	6,799,415	436,817	2,256,261	350,100	9,842,593
GA	Georgia	21,725	25,208	2,605,411	2,886,329	102,572	1,233,002	173,625	4,395,528
HI	Hawaii	9,671	906	381,692	454,114	127,481	95,155	28,943	705,693
IA	Iowa	15,461	69,143	1,087,563	1,142,712	56,135	299,373	46,216	1,544,436
ID	Idaho	19,199	19,566	422,430	458,042	31,191	171,215	26,313	686,761
IL	Illinois	12,878	46,000	4,338,535	4,793,302	369,943	2,291,516	345,990	7,800,750
IN	Indiana	16,819	13,028	2,158,477	2,298,122	144,525	783,106	120,592	3,346,345
KY	Kentucky	20,507	20,963	1,416,286	1,458,867	98,830	344,951	57,692	1,960,339
LA	Louisiana	18,893	20,239	1,537,547	1,708,877	54,403	525,587	75,399	2,364,266
MA	Massachusetts	13,107	1,300	2,252,345	2,781,210	818,518	521,997	174,267	4,295,992
MD	Maryland	13,430	1,542	1,838,791	2,115,297	62,015	1,071,710	147,384	3,396,407
ME	Maine	18,982	7,539	465,997	561,320	113,050	67,138	23,424	764,932
MI	Michigan	16,696	21,431	3,509,499	4,018,022	297,326	1,517,850	235,973	6,069,171
MN	Minnesota	16,297	61,681	1,691,851	1,870,647	37,364	692,396	94,869	2,695,275
MO	Missouri	16,983	62,507	2,025,368	2,201,659	114,786	720,628	108,604	3,145,677
MS	Mississippi	26,505	28,542	939,456	936,542	45,564	261,474	39,915	1,283,495
MT	Montana	20,331	28,317	326,093	344,102	13,487	92,546	13,784	463,919
NC	North Carolina	21,627	11,185	2,689,222	3,024,222	200,816	891,167	141,958	4,258,163
ND	North Dakota	19,256	35,740	241,311	280,967	9,836	87,257	12,622	390,682
NE	Nebraska	14,906	50,495	622,805	671,002	50,287	235,922	37,207	994,419
NH	New Hampshire	18,069	2,361	424,432	531,918	145,826	64,419	27,332	769,494
NJ	New Jersey	12,348	405	2,870,005	3,791,372	117,572	1,772,647	245,728	5,927,319
NM	New Mexico	20,043	22,624	599,417	620,326	25,795	183,070	27,152	856,344
NV	Nevada	14,108	5,640	586,189	689,264	156,078	154,586	40,386	1,040,314
NY	New York	10,693	14,981	6,691,596	8,055,847	2,220,072	1,689,883	508,294	12,474,096
OH	Ohio	14,405	10,722	4,197,454	4,495,125	286,419	1,473,992	228,853	6,484,389
OK	Oklahoma	17,760	50,613	1,254,334	1,301,348	58,256	401,179	59,727	1,820,510
OR	Oregon	16,666	23,118	1,214,021	1,309,609	84,316	430,120	66,877	1,890,922
PA	Pennsylvania	13,750	13,761	4,515,710	5,132,470	251,183	2,145,601	311,582	7,840,835
PR	Puerto Rico	14,261	127	1,116,904	1,251,603	52,208	202,341	33,091	1,539,243
RI	Rhode Island	14,689	22	384,549	450,468	117,370	60,383	23,108	651,329
SC	South Carolina	22,328	9,430	1,308,539	1,421,109	75,225	408,849	62,930	1,968,113
SD	South Dakota	20,095	38,138	267,049	278,984	10,283	87,744	12,744	389,755
TN	Tennessee	21,993	14,593	1,994,226	2,275,219	78,372	681,780	98,820	3,134,190
TX	Texas	19,578	111,481	6,674,564	7,260,882	395,226	2,934,398	432,851	11,023,358
UT	Utah	15,514	5,981	603,582	696,836	16,672	250,506	34,733	998,747
VA	Virginia	17,545	15,661	2,439,555	2,662,084	147,779	1,224,356	178,378	4,212,597
VT	Vermont	19,545	3,503	216,705	262,438	60,548	46,277	13,887	383,151
WA	Washington	16,082	24,730	2,073,972	2,274,572	133,773	757,450	115,859	3,281,654
WI	Wisconsin	16,263	33,038	1,905,166	2,146,167	119,346	854,113	126,550	3,246,176
WV	West Virginia	21,821	22,229	703,842	699,526	24,035	178,280	26,301	928,142
WY	Wyoming	22,703	11,490	175,920	185,690	4,968	67,344	9,401	267,403
	Total								

BCPM3 DESIGNS THE MOST EFFICIENT PROXY NETWORK

I. WHAT DEFINES THE MOST EFFICIENT NETWORK?

The most efficient network is not necessarily the network which is lowest in cost. Rather, it is the network which is lowest in cost to provide a **defined set of services**. It is possible to build a low cost telephone network which will provide marginal voice grade services, but fail to provide minimal access to data and other services. Furthermore, it is not just the initial cost which must be considered, but the life cycle costs over the expected life of the network. For example, a network with a low first cost but high maintenance costs may be less efficient than a network with higher first cost and significantly lower maintenance costs. Similarly, a network with a low first cost, but which would be expensive to reinforce as customer demand grows could well be more costly. Finally, if customer demand for services exceeds the ability of the network to provide them, requiring costly overbuilds of the network, then the initial network can hardly be called efficient.

II. WHAT SERVICES MUST THE CHOSEN PROXY NETWORK PROVIDE?

The services which must be provided by the network in the chosen proxy model are clearly spelled out in the Telecommunications Act of 1996...

> ***<u>Section 254(b) Universal Service Principles</u>*** *- The Joint Board and the Commission shall base policies for the preservation and advancement of universal service on the following principles:*

*(**2) Access to Advanced Services** - Access to advanced telecommunications and information services should be provided in all regions of the Nation.*
*(**3) Access in Rural and High Cost Areas** - Consumers in all regions of the Nation, including low-income consumers and those in rural, insular and high cost areas, should have access to telecommunications and information services, including interexchange services and advanced telecommunications and information services, that are reasonably comparable to those services provided in urban areas...*
*(**5) Specific and Predictable Support Mechanisms** - There should be specific, predictable and sufficient Federal and State mechanisms to preserve and advance universal service.*

Furthermore, the Act provides for periodic review of the definition of universal service:

> ***Section 254(c)(1) In General*** *- Universal service is an evolving level of telecommunications services that the Commission shall establish periodically under this section, taking into account advances in telecommunications and information technologies and services.*

In selecting a proxy model, the Commission must first determine what definition of "advanced services" they should include in their criteria for evaluating the models, and to what degree the "efficient" network will provide for an expanding definition of universal service without the need for extensive and expensive overbuilds of the network.

The BCPM sponsors submit that a conservative approach to identifying the services which compromise "access to advanced services" today would be to test the networks built by the models for the capability to support data transmission over a 28.8 Kbps modem. Network access at the 28.8 speed is widely available today in urban areas and thus, at the direction of Congress, must be available to customers in all areas of the nation including rural and high cost areas. We say that this is a conservative measure since modem speeds of 33.6 Kbps and even 56 Kbps are becoming more and more common, and ISDN and xDSL technologies are in the initial stages of wide-spread deployment. We use the 28.8 Kbps test for two reasons:

1. The Act states that services must be *reasonably comparable*, and
2. The Hatfield 5 and the HCPM will not be able to provide 28.8 connectivity to many customers, as we will demonstrate shortly.

III. WHAT ARE THE CRITERIA WHICH ARE PART OF AN EFFICIENT NETWORK DESIGN?

Following are quotes taken from the *Outside Plant Engineering Handbook* developed by AT&T Network Systems Customer Education and Training. They describe the type of factors which the Outside Plant Engineer must take into consideration when planning and designing the local network. The *Handbook* provides, in very plain straightforward language, a description of the types of analysis that the outside plant engineer must perform to design the optimal low-cost network. These are the very criteria which the BCPM sponsors use in designing their local networks, and which are reflected in the underlying network design assumptions of the BCPM3. The material in the Handbook is dated August 1994. The quotes which follow were selected to indicate the type of guidelines which are presented for the optimal planning and design of a local telephone network. Parenthetical references following each quotation refer to the section and page within the Handbook.

EXCHANGE NETWORK DESIGN

- *The outside facilities engineer is responsible for determining the type of outside facilities design that will best meet the needs of the company and the area to be served. There are three basic choices: (3-1)*

- *Aerial*
- *Underground*
- *Buried*

- *The engineer should evaluate the following for each type of facilities prior to proposing its construction: (3-1)*
  - *What is the Initial First Cost?*
  - *When is reinforcement of the facility likely to be required?*
  - *What are the potential maintenance costs and problems?*
  - *Is the potential for service disruption more likely with one type of facility than another due to storms, dig-ups, etc.?*
  - *Is there a governmental or company policy in place that dictates the type of facilities that must be constructed?*
- *The initial first cost, although an important consideration because it impacts today's money, should not be the only consideration. Evaluation of the remaining considerations may indicate a low initial first cost - but excessive future costs - either due to future reinforcement requirements or excessive maintenance costs. (3-2)*
- *Consideration must always be given to the next requirement that will affect an area currently being evaluated for relief. A job built today must not eliminate future alternatives; rather, it should be constructed considering the next relief requirement. (3-3)*
- *Copper primary (feeder) cable is normally sized to satisfy the growth requirements on a primary route for a period of 5 to 7 years. However there are many factors to consider that may affect the cable size and the growth period used to assist in determining cable size. For example: (3-7)*

  1. *Economic constraints may necessitate the placement of a less than optimum size primary cable.*
  2. *Company policy may dictate a shorter or longer growth period.*
  3. *Changes in anticipated growth patterns for an area may impact the amount of time a cable lasts, increasing or decreasing the amount of time the cable is able to satisfy requirements.*
  4. *The type of structure being utilized may affect the optimum size cable, for example:*
     - ***Aerial construction** - The lack of spare pole positions for additional aerial cable placement may necessitate the placing of a larger primary cable to avoid major rearrangements or structure reinforcement. This type of construction does have weight limitations, which can restrict the size or number of cables that can be installed.*
     - ***Underground construction** - Larger underground primary cables may be placed as the number of available spare ducts decreases. This practice can defer major conduit reinforcement for a significant period of time. Also,*

deployment of fiber optic cables can defer or eliminate conduit reinforcement.

- ***Buried construction** - Larger cables may be placed to avoid high construction costs associated with buying another cable in the not-too-distant future.*

An economic analysis of the alternatives will assist the engineer in choosing the best solution. Good engineering judgment, however, is essential in applying these guidelines to actual field requirements.

- *Interfaced secondary (distribution) cables are sized for the "ultimate" pair requirements. Accepted standards for pair allocations are as follows: (3-11)*
  - ***Residential** - two pairs per living unit. There are occasions when fewer than or more than two pairs per living unit are the optimum choice.*
  - ***Small business** - five pairs per business. When determining ultimate business lines, it is usually best to be liberal.*

BURIED PLANT

- *Buried plant is recommended as the first choice of providing outside plant (OSP) facilities beyond the underground network. (9-1)*
- *Filled polyethylene insulated conductor (PIC) cable is the only cable recommended for direct burial in the ground. (9-3)*
- *Buried distribution cables should be sized for the ultimate requirements of the living units and business locations within the area served by the cable. (9-3)*
- *In areas where both power and telephone utilities plan to bury their facilities, a joint trench is usually advantageous. Besides saving in installation cost, there is less likelihood of damage during construction. Successful joint operations require advance planning and close coordination with the utilities involved. **Joint trenching with power facilities should be employed only for distribution cables and service wires** (drop), **not for feeder or trunk cables.** (Emphasis in original) (9-6)*
- *Recommended depths for placing PIC cable. (9-12)*
  - *Toll, trunk cable 30 in.*
  - *Feeder, distribution cable 24 in.*
  - *Service wire 12 in.*
  - *Fiber optic cable 36 - 48 in.*
- *Trenching is preferred over plowing for installation in rocky soil, in urban or suburban environments with many obstacles, or in areas with difficult access. (9-15)*

AERIAL PLANT

- *Consider aerial design only if buried design is significantly more expensive or is not feasible. (10-1)*
- *The National Electric Safety Code (NESC) divides the United States into three storm loading areas based on the frequency, severity and damaging effects of ice*